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| FUJITA, KATRINA R | |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. 10/521,254 | Applicant(s) KAUS ET AL. | |
|---|---|---|---|
| | Examiner KATRINA FUJITA | Art Unit 2624 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *13 April 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-4 and 8-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 8-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 13, 2010 has been entered.

### *Response to Amendment*

2. This Office Action is responsive to Applicant's remarks received on April 13, 2010. Claims 1-4, 8-14 and newly added 15-20 remain pending. The Examiner also notes that claims 1, 8-10, and 12-14 contain both amendments reflected in the after final amendment filed on March 12, 2010 and in the RCE amendment filed on April 13, 2010. As the after final amendment was not entered, the following will be assumed as the markup for claims 1, 8-10, and 12-14:

1. (Currently Amended) A method for determining geometrical

properties of a structure of an object displayed in an image, comprising the steps of:

(a) adapting a deformable surface model to the object;

(b) applying additional geometrical information to the adapted deformable surface model of the object; and

(c) extracting the geometrical properties of the structure of the object from the adapted deformable surface model to which the additional geometrical information has been applied.

8. (Currently Amended) An image processing device, comprising:

a memory which stores a deformable model and an image depicting an object; and

an image processor which determines geometrical properties of the object, wherein the Processor is programmed to perform the following operations:

(a) adapting a deformable surface model to the object;

(b) applying additional geometrical information to the adapted deformable surface model of the object; and

(c) extracting the geometrical properties of [[the]] a structure of the object from the adapted deformable surface model to which the additional geometrical information has been applied.

9. (Currently Amended) A computer-readable medium having processor-executable instructions thereon for execution by a processor of an image processing device to

control the processor to determine geometrical properties of an object by performing the steps:

(a) adapting a deformable surface model to the object;

(b) applying additional geometrical information to the adapted deformable surface model of the object; and

(c) extracting the geometrical properties of [[the]] a structure of the object from the adapted deformable surface model to which the additional geometrical information has been applied.

10. (Currently Amended) A method for determining geometric properties of a subpart of an object, comprising:

(a) with a processor, applying a ~~an extended~~ deformable model represented by a polygon mesh to a surface of an object of interest from an image;

(b) with the processor, [[fitting]] deforming the deformable model to optimally fit a surface of at least one sub-part of the surface of the object of interest;

(c) with the processor, determining geometrical properties of the object of interest based on the deformable model fit to the sub-part.

13. (Currently Amended) The method according to claim 12, wherein the object is a bone the first and second sub-parts are an end[[s]] and a shaft, respectively, of the bone, the first and second geometric primitives are ~~first and second~~ a sphere[[s]] and a line, respectively, and the geometric property of the object is at least one of a location

an orientation, and/or a center which are derived directly from parameters of the first and second primitives ~~distance between the centers of the first and second spheres~~.

14. (Currently Amended) The method according to claim 10, wherein the step of [[fitting]] deforming the deformable model to optimally fit the surface of the sub-part of the object, further includes:

identifying a plurality of surface points of the surface of the sub-part of the object; and

altering the polygon mesh to fit vertices of the polygons mesh to the identified surface points.

***Claim Objections***

3. The previous claim objections have been withdrawn in light of Applicant's amendment.

***Claim Rejections - 35 USC § 112***

4. The previous 112 rejection has been withdrawn in light of Applicant's amendment.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 10, 15, 18 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claim 10 recites the limitation "geometrical properties" in line 7. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 15 recites the limitation "adapted deformable surface mode" in line 2. There is insufficient antecedent basis for this limitation in the claim.

9. Claim 18 recites the limitation "points of interaction" in line 6. There is insufficient antecedent basis for this limitation in the claim.

10. Claim 19 recites the limitation "adapted deformable surface mode" in line 2. There is insufficient antecedent basis for this limitation in the claim.

### *Claim Rejections - 35 USC § 101*

11. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO “Subject Matter Eligibility of Computer Readable Media” (Official Gazette notice of 23 February 2010), reads as follows:

> The broadest reasonable interpretation of a claim drawn to a computer readable medium (also called machine readable medium and other such variations) typically covers forms of non-transitory tangible media and transitory propagating signals per se in view of the ordinary and customary meaning of computer readable media, particularly when the specification is silent. See MPEP 2111.01.
>
> When the broadest reasonable interpretation of a claim covers a signal per se, the claim must be rejected under 35 U.S.C. § 101 as covering non-statutory subject matter. See In re Nuijten, 500 F.3d 1346, 1356-57 (Fed. Cir. 2007) (transitory embodiments are not directed to statutory subject matter) and Interim Examination Instructions for Evaluating Subject Matter Eligibility Under 35 U.S.C. § 101, Aug. 24, 2009; p. 2.

12. Claim 9 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows. Claim 9 is drawn to functional descriptive material recorded on a computer-readable medium. Normally, the claim would be statutory. One of ordinary skill in the art will recognize that a computer readable medium can encompass statutory media such as a "CD-ROM", "hard drive", "optical drive", etc, as well as ***non-statutory*** subject matter such as a <u>"signal"</u> or "<u>carrier wave</u>".

"A transitory, propagating signal … is not a "process, machine, manufacture, or composition of matter." Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter." (*In re Nuijten*, 84 USPQ2d 1495 (Fed. Cir. 2007)).

Because the full scope of the claim can encompass non-statutory subject matter the claim as a whole is non-statutory. The examiner suggests amending the claims to add the phrase "non-transitory" to cover only statutory subject matter (See Official Gazette notice at paragraph 2). Any amendment to the claim should be commensurate with its corresponding disclosure.

## *Claim Rejections - 35 USC § 103*

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 1-4, 8-12, 14-16, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wu ("Computing parametric geon descriptions of 3d multi-part objects", Thesis) and Holten-Lund et al. ("VRML Visualization…", ACM Article).

Regarding **claim 1**, Wu discloses a method for determining geometrical properties of a structure of an object displayed in an image ("three-dimensional (3D) shape representation of objects based on parts" at page 1, last paragraph, line 1) comprising the steps of:

adapting a deformable surface model to the object ("sphere is deformed towards the shape of the object and residuals between the model and data points are computed" at page 56, line 10; figure 4.9);

applying additional geometrical information to the adapted deformable surface model of the object ("parametric geon models are fitted to an object part" at page 61, line 8).

Wu does not disclose extracting the geometric properties of the structure of the object from the adapted deformable surface model to which additional geometrical information has been applied.

Holten-Lund et al. teaches a method for determining geometrical properties of a structure of an object displayed in an image (“make the necessary measurements of the deformation” at section 1, paragraph 4, line 1), comprising:

extracting the geometric properties of the structure of the object (“measure the topology” at section 3, paragraph 2, line 5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”) from the adapted deformable surface model (“iso-surface” at section 3, paragraph 2, line 1; the iso-surface models are also editable for simulation: "For editing isosurface models it is useful to be able to cut away parts of the model" at page 113, section 2.1.2, line 1) to which additional geometrical information has been applied (“approximate primitives" at section 3, paragraph 2, line 4; figure 9, spherical primitive).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the measurements of Holten-Lund et al. on the adapted models of Wu such that further understanding of object parts may be obtained by providing a quantification of the data, in addition to allowing the Wu method to have a particular applicability to the field of medical imaging (see Holten-Lund et al. at section 1, paragraphs 3 and 4).

Regarding **claim 8**, Wu discloses an image processing device (“SPARC-10 or SGI R4000 or R8000 workstations” at page 81, line 7), comprising:

a memory (memory of workstation) which stores a deformable model (figure 4.9) and an image depicting an object (figure 4.7); and

an image processor (processor of workstation) which determines geometrical properties of the object (“three-dimensional (3D) shape representation of objects based on parts” at page 1, last paragraph, line 1), wherein the processor is programmed to perform the following operation:

adapting a deformable surface model to the object (“sphere is deformed towards the shape of the object and residuals between the model and data points are computed" at page 56, line 10; figure 4.9);

applying additional geometrical information to the adapted deformable surface model of the object (“parametric geon models are fitted to an object part" at page 61, line 8).

Wu does not disclose extracting the geometric properties of the structure of the object from the adapted deformable surface model to which additional geometrical information has been applied.

Holten-Lund et al. teaches an image processing device, comprising:

a processor (processor of PC, implied by section 3.2) for determining geometrical properties of the object (“make the necessary measurements of the deformation” at section 1, paragraph 4, line 1), which processor performs the following:

extracting the geometric properties of the structure of the object (“measure the topology” at section 3, paragraph 2, line 5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”) from the adapted deformable

surface model ("iso-surface" at section 3, paragraph 2, line 1;the iso-surface models are also editable for simulation: "For editing isosurface models it is useful to be able to cut away parts of the model" at page 113, section 2.1.2, line 1) to which additional geometrical information has been applied ("approximate primitives" at section 3, paragraph 2, line 4; figure 9, spherical primitive).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the measurements of Holten-Lund et al. on the adapted models of Wu such that further understanding of object parts may be obtained by providing a quantification of the data, in addition to allowing the Wu method to have a particular applicability to the field of medical imaging (see Holten-Lund et al. at section 1, paragraphs 3 and 4).

Regarding **claim 2**, Wu discloses a method wherein the step of applying additional geometrical information to the adapted deformable surface model of the object further comprises the steps of:

identifying surface elements of the deformable surface model relating to a particular sub-part of the object ("triangles belonging to the same physical part are obtained by a connected component labelling process" at page 42, line 12); and

fitting a geometrical primitive to the surface elements relating to the particular sub-part of the object in the deformable surface model, the geometrical primitive having a form corresponding to a form of the particular sub-part ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" at page 61, line 9; figure 6.25).

Regarding **claim 3**, Holten-Lund et al. discloses a method wherein the geometrical properties of the object are extracted on the basis of the geometrical primitive ("To make the necessary measurements of the deformation we chose to approximate relevant parts of the femur-pelvis area with simple 3D primitives" at section 1, paragraph 4, line 1).

Regarding **claim 4**, Wu discloses a method wherein the surface elements of the particular sub-part of the object are identified by means of labels assigned to the surface elements belonging to the particular sub-part ("triangles belonging to the same physical part are obtained by a connected component labelling process" at page 42, line 12).

Regarding **claim 9**, the Wu and Holten-Lund et al. combination a computer-readable medium having processor-executable instructions thereon ("All programs were written in C or C++ and were run on SPARC-10 or SGI R4000 or R8000 workstations" Wu at page 81, line 7) for execution by a processor of the image processing device above to control the processor to perform the method of claim 1 as described above.

Regarding **claim 10**, Wu discloses a method for determining geometric properties of a subpart of an object ("finite element model in the form of a closed triangular mesh is created over the object surface" at page 42, line 7), comprising:

with a processor (processor of "SPARC-10 or SGI R4000 or R8000 workstations" at page 81, line 7), applying an extended deformable model represented by a polygon mesh to a surface of an object of interest from an image ("sphere is deformed towards

the shape of the object and residuals between the model and data points are computed" at page 56, line 10; figure 4.9);

with the processor, fitting the deformable model to optimally fit a surface of at least one sub-part of the surface of the object of interest (“parametric geon models are fitted to an object part by minimising a function of the different between the shape and size of a part and the models; the best model for that part is selected" at page 61, line 8).

Wu does not disclose determining geometrical properties of the object of interest based on the deformable model fit to the sub-part.

Holten-Lund et al. teaches a method for determining geometric properties of a subpart of an object (“make the necessary measurements of the deformation” at section 1, paragraph 4, line 1), comprising:

with the processor (processor of PC, implied by section 3.2), determining geometrical properties of the object of interest (“measure the topology” at section 3, paragraph 2, line 5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”) based on the deformable model fit to the sub-part (“iso-surface” at section 3, paragraph 2, line 1; the iso-surface models are also editable for simulation: "For editing isosurface models it is useful to be able to cut away parts of the model" at page 113, section 2.1.2, line 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the measurements of Holten-Lund et al. on the adapted models of Wu such that further understanding of object parts may be obtained by providing a

quantification of the data, in addition to allowing the Wu method to have a particular applicability to the field of medical imaging (see Holten-Lund et al. at section 1, paragraphs 3 and 4).

Regarding **claim 11**, the Wu and Holten-Lund et al. combination discloses a method further including:

labeling elements of the polygon mesh corresponding to the at least one sub-part of interest ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12); and

fitting a geometric primitive to the labeled elements of the polygon mesh corresponding to each of the at least one sub-part of interest ("All parametric geon models are fitted to an object part" Wu at page 61, line 8; "best model for that part is selected" Wu at page 61, line 9); and

wherein the geometric properties of the object are determined based on the geometric primitive ("To make the necessary measurements of the deformation we chose to approximate relevant parts of the femur-pelvis area with simple 3D primitives" Holten-Lund et al. at section 1, paragraph 4, line 1).

Regarding **claim 12**, the Wu and Holten-Lund et al. combination discloses a method wherein the deformable model is fit to at least first and second sub-parts of the object and further including:

identifying elements of the polygon mesh fit to the first sub-part ("triangles belonging to the same physical part are obtained by a connected component labelling

process” Wu at page 42, line 12 corresponding to the part defined by the cylinder in figure 6.25b);

identifying elements of the polygon mesh fit to the second sub-part (“triangles belonging to the same physical part are obtained by a connected component labelling process” Wu at page 42, line 12 corresponding to the part defined by the sphere in figure 6.25b);

fitting a first geometric primitive to the elements of the polygon mesh fit to the first sub-part (“All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models” Wu at page 61, line 9; cylinder in figure 6.25b);

fitting a second geometric primitive to the elements of the polygon mesh fit to the second sub-part (“All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models” Wu at page 61, line 9; sphere in figure 6.25b); and

determining the geometric properties of the object using properties of the first and second geometric primitives (“measure the topology” Holten-Lund at section 3, paragraph 2, line 5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”; “iso-surface” at section 3, paragraph 2, line 1; as each part is labeled, each can be measured utilizing the method of Holten-Lund on each part).

Regarding **claim 14**, Wu discloses a method wherein the step of fitting the deformable model to optimally fit the surface of the sub-part of the object, further includes:

identifying a plurality of surface points of the surface of the sub-part of the object ("triangles belonging to the same physical part are obtained by a connected component labelling process" at page 42, line 12); and

altering the polygon mesh to fit vertices of the polygons mesh to the identified surface points ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" at page 61, line 9; figure 6.25).

Regarding **claim 15**, the Wu and Holten-Lund combination discloses a method wherein step (b) of applying additional geometrical information to the adapted deformable surface mode information includes:

identifying surface elements belonging to subparts of the object ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12);

labeling surface elements belonging to the respective subparts of the object ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12);

selecting a geometric primitive in accordance with a measurement to be carried out and form a selected corresponding subpart ("measure the topology" Holten-Lund at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are

shown” at window labeled “Angle-ent6”; the sphere primitive is selected for measurements associated with the femoral head);

fitting the geometric primitive to the surface elements of the selected corresponding subpart (“All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models” Wu at page 61, line 9; figure 6.25); and

determining a rule which maps the geometric primitive onto the selected corresponding subpart (“these primitives are calculated from vertices and their respective normals on an iso-surface model of the bone surface” Holten-Lund at page 112, section 2, line 3; figure 2, "A plane approximated from vertices on the acetabular rim"; "Vertices and normals are sent to the Script node which calculates “ approximating sphere and sends its center and radius to the wireframe model” at page 114, Figure 7).

Regarding **claim 16**, the Wu and Holten-Lund combination discloses a method wherein the object is a femur and the subparts include a femur head and a femur shaft (figure 9 of Holten-Lund shows that the object is a femur that includes a femur head and shaft).

Regarding **claim 19**, the Wu and Holten-Lund combination discloses a method wherein step (b) of applying additional geometrical information to the adapted deformable surface mode information includes:

identifying surface elements belonging to subparts of the object (“triangles belonging to the same physical part are obtained by a connected component labelling process” Wu at page 42, line 12);

labeling surface elements belonging to the respective subparts of the object (“triangles belonging to the same physical part are obtained by a connected component labelling process” Wu at page 42, line 12);

selecting a geometric primitive in accordance with a measurement to be carried out and form a selected corresponding subpart (“measure the topology” Holten-Lund at section 3, paragraph 2, line 5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”; the sphere primitive is selected for measurements associated with the femoral head);

fitting the geometric primitive to the surface elements of the selected corresponding subpart (“All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models” Wu at page 61, line 9; figure 6.25); and

determining a rule which maps the geometric primitive onto the selected corresponding subpart (“these primitives are calculated from vertices and their respective normals on an iso-surface model of the bone surface” Holten-Lund at page 112, section 2, line 3; figure 2, "A plane approximated from vertices on the acetabular rim"; "Vertices and normals are sent to the Script node which calculates “ approximating sphere and sends its center and radius to the wireframe model” at page 114, Figure 7).

Regarding **claim 20**, the Wu and Holten-Lund combination discloses a method wherein measuring geometric properties of the object includes:

measuring properties of the fit geometric primitive ("measure the topology" Holten-Lund at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6").

15. Claims 13 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wu and Holten-Lund as applied to claims 12 and 16 above, and further in view of Pelletier et al. (US 6,560,476).

Regarding **claim 13**, the Wu and Holten-Lund combination discloses a method wherein the object is a bone (figure 9 of Holten-Lund) the first sub-part is an end of the bone (femur head in figure 9) and the geometric property of the object is at least one of a location, an orientation, and/or a center which are derived directly from the parameters of the first primitives (figure 9 shows the orientation of the femur which is derived from the positioning of the sphere; figure 9 also shows different possibilities for measurements, e.g. distance, point).

The Wu and Holten-Lund combination does not disclose that the second sub-part is a shaft of the bone and the second geometric primitive is a line and the geometric property of the object is derived directly from parameters of the second primitive.

Pelletier et al. teaches a method in the same field of endeavor of 3D medical imaging visualization, wherein the object is a bone and the sub-part is a shaft of the bone, the geometric primitive is a line and the geometric property of the object is derived directly from parameters of the primitive ("Referring to FIG. 8, once the data set has been segmented, the system fits (step 50) a simple geometrical primitive to the 3D

active contour results from the bone-cartilage interface. The primitive is chosen to mimic the shape of the bone surface. A cylinder is used for the femur and planes are used for the tibia and patella" at col. 13, line 16; "Different structures within a joint can be quantified separately using the mask map" at col. 14, line 24; a cylinder is analogous to a line, as it is a line with a wider cross-sectional radius).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a line as taught by Pelletier et al. to model the shaft of the Wu and Holten-Lund combination to achieve the predictable results of representing the orientation and location of the bone shaft such that further diagnostic information can be gathered from its visualization.

Regarding **claim 17**, the Wu and Holten-Lund combination discloses a method wherein the geometric primitive fit to the femur head includes a sphere (figure 9 of Holten-Lund).

The Wu and Holten-Lund combination does not disclose that the geometric primitive fit to the femur shaft includes a straight line.

Pelletier et al. teaches a method in the same field of endeavor of 3D medical imaging visualization, wherein the geometric primitive fit to the femur shaft includes a straight line ("Referring to FIG. 8, once the data set has been segmented, the system fits (step 50) a simple geometrical primitive to the 3D active contour results from the bone-cartilage interface. The primitive is chosen to mimic the shape of the bone surface. A cylinder is used for the femur and planes are used for the tibia and patella" at col. 13, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a line as taught by Pelletier et al. to model the shaft of the Wu and Holten-Lund combination to achieve the predictable results of representing the orientation and location of the bone shaft such that further diagnostic information can be gathered from its visualization.

16. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wu and Holten-Lund as applied to claim 1 above, and further in view of Frisken et al. (US 6,396,492).

The Wu and Holten-Lund combination discloses a method wherein the deformable surface model includes a mesh of triangles, each triangle having a normal (“a finite element model in the form of a closed triangular mesh is created over the object surface” Wu at page 42, paragraph 1, line 7; the triangles have a normal to them), further including:

measuring geometric properties of the object (“measure the topology” Holten-Lund at section 3, paragraph 2, line 5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”).

The Wu and Holten-Lund combination does not explicitly disclose (d) for each triangle, carrying out a search along a triangle normal to find a point of intersection with the object, (e) formulating an energy function from the points of interaction (f) minimizing the energy function to define new triangle coordinates; (g) iteratively repeating steps (d)-(f) to generate a deformed model.

Frisken et al. teaches a method in the same field of endeavor object visualization wherein the deformable surface model includes a mesh of triangles, each triangle having a normal, further including:

(d) for each triangle, carrying out a search along a triangle normal to find a point of intersection with the object ("produces parametric patches from the patch vertices and normals, and tags the vertices as good or bad depending on how well their corresponding patches fit the surface represented by the HDF" at col. 19, line 9);

(e) formulating an energy function from the points of interaction ("energy contribution of neighboring vertex positions, the distance of a vertex from an HDF iso-surface, and constraints to keep the vertices inside the surface cells" at col. 18, line 65);

(f) minimizing the energy function to define new triangle coordinates ("minimizing a total energy of the mesh 1731 according the energy contribution of neighboring vertex positions, the distance of a vertex from an HDF iso-surface, and constraints to keep the vertices inside the surface cells" at col. 18, line 64);

(g) iteratively repeating steps (d)-(f) to generate a deformed model ("subdivides all surface cells with vertices tagged as bad, updates 1771 the linked surface mesh 1731 and reiterates 1772 at step 1740, until all patch vertices are tagged as good and the final parametric patches 1790 are output" at col. 19, line 21).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to use the iso-surface generation of Frisken et al. to create the iso-surfaces of the Wu and Holten-Lund combination to provide a "practical sampled representation of large objects with fine surface detail" (Frisken et al. at col. 24, line 34).

***Response to Arguments***

Summary of Remarks (@ response page labeled 7): The Examiner has not provided an explanation of what new matter issues that are raised by the previously presented claims, specifically independent Claims 1, 8, 9 and 10.

Examiner's Response: The Examiner has not asserted in the previous Office Action that there are new matter issues with claims 1 and 8-10.

Summary of Remarks (@ response page labeled 8). Holten-Lund teaches away from adapting a deformable surface model.

Examiner's Response: The fact that Holten-Lund utilizes an iso-surface model created by a marching cubes algorithm is irrelevant. Holten-Lund takes that iso-surface model and is able to edit it during the course of processing the image data for visualization as exemplified in the rejection above. As such, the surface model is deformable to the specifications of the user.

Summary of Remarks (@ response page labeled 9): Holten-Lund does not provide an enabling disclosure as page 115, section 2.3, paragraphs 1 and 2 state that the described process could not be performed with available browsers.

Examiner's Response: Firstly, the Examiner notes that this section is specifically for the VRML centered solution browser, which was not utilized by the Examiner for the support in the rejections. Secondly, the prototypes as presented by Holten-Lund performed the functions as described to generate the results shown in figures 2, 6, 8 and 9, thereby creating an enabling disclosure to support the rejection of the claims. Holten-Lund is able to perform the functions using their own workarounds and therefore meets the claim limitations.

## *Conclusion*

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATRINA FUJITA whose telephone number is (571)270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katrina Fujita/
Examiner, Art Unit 2624

/VIKKRAM BALI/
Supervisory Patent Examiner, Art Unit 2624